

REMARKS

Claims 1-11 are pending and stand ready for further action on the merits.

The Abstract has been amended. A clean copy of the Abstract is attached as an Appendix to this Reply.

The specification has been amended for clarity.

Claims 1, 3 and 4 have been amended to improve clarity. Support for new claim 8 can be found on page 7, lines 8-11. Support for new claim 9 can be found in claim 1. Support for new claim 10 can be found on page 6, lines 22-25. Support for new claim 11 can be found on page 5, lines 5-12.

No new matter has been added by way of the above-amendment. The above-amendment to claim 1 does not narrow the scope of the present invention and/or has not been made for the sake of patentability.

The following sections correspond to the sections of the outstanding Office Action.

[II] Specification

The Examiner has objected to the specification for containing minor informalities. Applicants have amended the Abstract and page 8, Example 1, line 1 as suggested by the Examiner. A clean copy of the Abstract is attached as an Appendix to this Reply.

Accordingly, withdrawal of the objection is respectfully requested.

[III] Claim Objections

Claims 1, 3 and 4 have been objected to for containing minor informalities. In accordance with the Examiner's suggestion, Applicants have amended these claims. Accordingly, withdrawal of the objection to the claims is respectfully requested.

[IV] Issues Under 35 U.S.C. §112, second paragraph

Claim 3 is rejected under 35 U.S.C. §112, second paragraph for being indefinite. Specifically, the Examiner has taken the position that the phrase "the ion-exchange substance" does not have antecedent basis. In response, Applicants have amended claim 3 to depend from claim 2 which first recites the "ion-exchange substance."

Based on the above amendment to claim 3, Applicants respectfully submit that claim 3 particularly points out and distinctly claims the subject matter which Applicants regard as the invention. Accordingly, withdrawal of the rejection is respectfully requested.

[IV] Prior Art Based Issues

The following prior art rejections are pending:

- (a) Claims 1-7 are rejected under 35 U.S.C. §102(b) as being anticipated by Mouri et al., U.S. 5,690,922;
- (b) Claims 1-7 are rejected under 35 U.S.C. §102(b) as being anticipated by Hu et al., U.S. 5,385,753; and
- (c) Claims 1-7 are rejected under 35 U.S.C. §102(e) as being anticipated by Ogata et al., U.S. 6,238,631.

Applicants respectfully traverse each of the rejections.

It appears that the above-rejections are based upon a misinterpretation of the teachings of Mouri et al., Hu et al. and Ogata et al. Specifically, these references teach the use of metal oxides such as silica, alumina, zeolite, MAPO and SAPO which are conventionally used as "catalysts" not as "photocatalysts" as presently claimed. A catalyst is defined in the art as a substance which reduces the thermodynamic barrier between reactants and products in a reaction by virtue of its unique geometric and electronic structure. Usually, the presence of light radiation has no affect on the thermodynamics of the reaction using these general "catalysts." This is in distinction to a photocatalyst which always requires light radiation as an energy source to overcome the thermodynamic barrier between reactants and products.

Conventionally a metal oxide such as silica, alumina, zeolite, MAPO, SAPO has been used as a carrier (or support) for a photocatalyst. As mentioned above, these carrier substances

(zeolite A, zeolite Y, ZSM-5 zeolite or MAPO-11) may be used as a catalyst by themselves, indeed silica can be used as a cracking catalyst by itself, however, they are not photocatalysts.

Accordingly, the present invention is entirely different from the teachings of the cited references. Applicants now provide further details of the particular features of the present invention which render the present invention patentable over the cited prior art.

[IV - A] Features of the Present Invention:

A patentable feature of the present invention is that the photocatalyst, such as titanium dioxide, is partially covered with e.g. silica. This gives the surface an electric charge which allows for the efficient adsorption of harmful substances having the opposite electric charge, to improve the decomposing efficiency of the photocatalyst.

Further, because the silica is prepared from sodium silicate, an adsorbent having a large surface-area can be obtained. This leads to an improvement in the adsorption-efficiency.

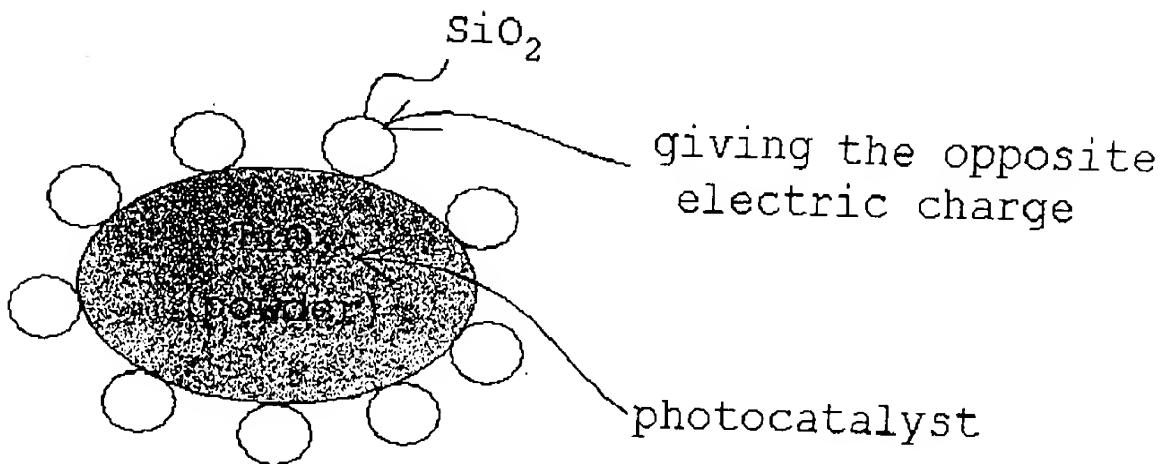
It is noted that conventionally, adsorbent-particles are covered with a titanium dioxide sol. However, to the contrary, in the present invention, adsorbent-particles cover

titanium dioxide particles, so that a more efficient photocatalyst can be obtained.

In addition, it is noted that the present inventors have overcome the difficulty in covering a photocatalyst with an adsorbent.

IV - B1 Graphic Explanation:

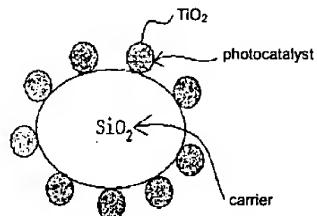
The present invention is graphically shown below.



As can be seen from the above non-limiting representation, the TiO<sub>2</sub> photocatalyst is covered by silica particles. This is in

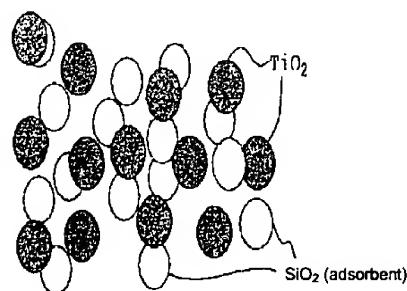
distinction to the photocatalyst of the prior art which is depicted as structures (a) and (b) below.

(a) Photocatalyst and a carrier thereof



or

(b) Blending of absorbent and  $\text{TiO}_2$



[IV - C] Differences between the Present Invention and the Cited Prior Art:

[IV - C - ii] Mouri et al., (U.S. Patent No. 5,690,922) :

Mouri et al. teach a deodorizable fiber incorporating a photocatalyst (e.g. TiO<sub>2</sub>) and an adsorbent (see column 2, lines 39 to 43; column 3, lines 11 to 18). Therefore, in Mouri et al.'s invention, a fiber is an essential component. This deodorizable fiber has a sheath-core structure, a side-by-side structure, a hollow-shape, etc. (See Column 2, Lines 52 to 60).

Accordingly, Mouri et al.'s invention aims mainly to eliminate malodorous or harmful components by adsorption with the fiber incorporating an absorbent (see column 16, lines 64 to 67). It is expected that the ability of the titanium dioxide to act as a photocatalyst is lowered by this arrangement.

On the other hand, the present invention provides a photocatalyst with a surface component having an opposite electric charge. This electric charge on the surface of the photocatalyst, allows for the efficient adsorption of harmful substances having the opposite electric charge.

Certainly, in Mouri et al.'s invention, the essential adsorbent comprises a phosphate of a tetravalent metal and a hydroxide of a divalent metal (see column 2, lines 39 to

43). On the other hand, the electrically charged substance of the present invention may be a hydroxide or phosphate of silicon, aluminum or zirconium (see page 4, lines 14 to 16 of the present specification). Accordingly, at least one hydroxide or phosphate is enough to provide the inventive photocatalyst with sufficient adsorption.

Furthermore, in Mouri et al.'s invention, the adsorbent may be SiO<sub>2</sub>. However, SiO<sub>2</sub> is an optional adsorbent (see column 6, lines 37 to 52) but is not essential.

Therefore, Mouri et al.'s invention is entirely different from the present invention.

In describing the requirements for rejection of a claim by anticipation, the Manual of Patent Examining Procedure (Section 2131) states:

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference (ref. omitted).

The identical invention must be shown in as complete detail as is contained in the... claim (ref. omitted).

Accordingly, Applicants respectfully indicate, every element in a claim must be found in the reference in order that the reference anticipates the claim. Mouri et al. fail to teach (explicitly or inherently) a photocatalyst, having an opposite electric charge to a substance to be treated, in which the opposite electric charge is given by carrying an inorganic substance on a surface of the photocatalyst. Therefore, Mouri et al. do not anticipate the claims, and as such, Applicants respectfully request that the rejection based on Mouri et al. is withdrawn.

[IV - C - iii] Hu et al. (U.S. Patent 5,385,753):

Hu et al. teach a zeolite which is covered using with aqueous titanium dioxide sol. This technique is not preferred since the placement of the titanium dioxide on the zeolite is difficult (see column 4, lines 35 to 39; column 5, lines 25 and 26; column 5, lines 52 and 53; and column 6, lines 21 and 22). Furthermore, the final composition is prepared by blending (i.e., mixing the components) an adsorbent with titanium dioxide sol and drying and heating the resultant product (see column 6, lines 30 to 39). Accordingly, it is expected that the final composition probably has a small decomposing efficiency due to the reduction in the number of sites on the surface of photocatalyst that remain active.

To the contrary, in the present invention, the surface of the photocatalyst is partially covered with a surface component having an opposite electric charge.

As mentioned above, every element in a claim must be found in the reference in order that the reference anticipates the claim. Hu et al. fail to teach (explicitly or inherently) a photocatalyst, having an opposite electric charge to a substance to be treated, in which the opposite electric charge is given by carrying an inorganic substance on a surface of the photocatalyst. Therefore, Hu et al. do not anticipate the claims, and as such, Applicants respectfully request that the rejection based on Hu et al. is withdrawn.

[IV - C - iii] Ogata et al. (U.S. Patent No. 6,238,631):

Similar to Hu et al. as described in section [IV - C - ii] above, Ogata et al. teach a photocatalyst which is prepared from an aqueous sol (fluid stream, see column 2, lines 35 to 39). Furthermore, the adsorbent used has low ionicity. Therefore, it is expected that the photocatalyst of Ogata et al. has a low decomposing efficiency.

In addition, it is taught by Ogata et al. that the importance of the structural features of the composition is not the surface area of the adsorbent but the porous structure (See column 8, lines 23 to 25).

As mentioned above, every element in a claim must be found in the reference in order that the reference anticipates the claim. Ogata et al. fail to teach (explicitly or inherently) a photocatalyst, having an opposite electric charge to a substance to be treated, in which the opposite electric charge is given by carrying an inorganic substance on a surface of the photocatalyst. Therefore, Ogata et al. do not anticipate the claims, and as such, Applicants respectfully request that the rejection based on Ogata et al. is withdrawn.

[V] Information Disclosure Statement (IDS)

On June 19, 2003, Applicants timely filed an IDS. Even though the PTO-1449 form was signed by the Examiner, the Examiner did not put his initials next to the listing of each reference. Accordingly, Applicants enclose herewith a Supplemental PTO-1449 Form. Applicants respectfully request that the Examiner initials next to each reference indicating that all of the references have been considered. Also, the Examiner is respectfully requested to forward the signed Supplemental PTO-1449 Form with the next communication.

Conclusion

In view of the above amendments and comments, Applicants respectfully submit that the claims are in condition for allowance. A notice to such effect is earnestly solicited.

Pursuant to the provisions of 37 C.F.R. §§ 1.17 and 1.136(a), the Applicants hereby petition for an extension of one (1) month to December 25, 2003 in which to file a reply to the Office Action. The required fee of \$110.00 is enclosed herewith.

If the Examiner has any questions concerning this application, he is requested to contact Garth M. Dahlen, Ph.D., Esq. (#43,575) at the offices of Birch, Stewart, Kolasch & Birch, LLP.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Enclosures:

- 1) Abstract (clean copy)
- 2) Supplemental PTO-1449 Form (June 19, 2003 IDS)

**ABSTRACT OF THE DISCLOSURE**

A photocatalyst, which has an opposite electric charge to a substance to be treated, in which the opposite electric charge is given by carrying an inorganic substance on a surface of the photocatalyst. A method for producing the photocatalyst.